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Muskmelon, erroneously called cantaloupe, is a popular fruiting vegetable in many ares of the world and is a valuable crop in the U.S.A. It is produced in most states with California, Arizona, Texas and Oklahoma producing large volumes for long-distance shipping. The type produced in these states is usually a highly netted, non-ribbed, hard rind, round shape type of fruit. Midwestern and eastern states usually supply fruits which are ribbed, moderately netted and usually larger fruited types. The former are usually classed as western-type melons and the latter are eastern-type melons.

Fruit quality of melons is greatly influenced by sugar content. The sugars are produced in the leaves and thus leaves are very important to sugar content. Sunlight is necessary for sugar manufacture and seasons which have above normal, cloudy weather as fruits are nearing maturity, usually have plants which produce low-quality fruits. Melons also have higher quality when grown under high temperature conditions than when seasons are cooler than normal.

A full complement of leaves is critical to fruit set and development of quality fruits. Injury to the foliage from insects, disease or mechanical injury such as hail, may influence the numbers of fruits produced as well as fruit quality. This study was undertaken to determine the influence of hail on yield. Quality was not studied because of the many factors which influence quality.

Objectives

1. To develop a description of muskmelon growth and development.
2. To determine the influence of early stand loss on subsequent yield.

3. To determine the influence of plant injury from simulated hail on subsequent yield.

Materials and Methods

General: The field plots were established at the OARDC Vegetable Crops Branch near Fremont, Ohio in 1989, 1990 and 1991. The soil is classed as a sandy loam and is similar to soils in the eastern U.S. where melons are produced. The variety used in 1989 and 1990 was SuperStar (Harris-Moran Seed Co.), and Gold Star, (Harris-Moran) in 1991. The former is the most popular variety in the northeastern U.S. and Gold Star has been a standard for many years also in that area. This variety switch will be discussed later. The use of black plastic mulch and other cultural practices were near to what commercial growers would follow in their production programs. Irrigation was used when necessary to maintain the study. A regular pesticide program was used and no additional treatments were made following hail treatment to control any potential disease threat.

Plot rows were 30 ft. long with 20, 2-plant hills per row. Rows were on 4 ft. 1.5 mil black plastic on 6 ft. centers. Harvesting was by hand at full-slip of melon maturity. There were 5 pickings in 1989, 9 in 1990 and 11 in 1991. The number of pickings were related to variety and temperature conditions during the season. Fruits were graded as marketable and culls.

Hail Injury: Hail treatments were made at 3 stages of plant development: 1) when runners were 6-12 inches long; 2) when first pistillate flowers are open. In a few cases some small fruits were evident because of the very wide range of plant development in muskmelon; 3) early fruit growth when the early fruits are 1 to 4 inches in diameter.

A range of severity was used based upon defoliation. In 1989 and 1990 a finely crushed ice was available and it was very effective in causing defoliation of up to 90%. However, in 1991, the only ice available was in small chunks which ranged from about 1/2 to 1 inch across and it was difficult to achieve high levels of defoliation without cutting the plants off completely. The defoliation rating was done by 2 or 3 persons who had considerable experience doing this from previous studies. The rating was done 1 or 2 days after treatment to allow for the injured foliage to die.

Stand Reduction: Plots were established with stands of 100, 90, 75 and 50 percent at the time of planting. It was assumed that a 100 percent stand was the standard of 2-plant hills spaced 18 inches apart in the rows, 6 ft. apart. Rows were 30 ft. long and, therefore, a full stand had 20 hills per row. Since muskmelon is normally transplanted, there was no effort made to plant and remove the plants to give the desired stand. Furthermore, the missing plants were randomly spaced which prevented several adjacent plant spots from becoming one long vacant space down a row.

Results and Discussion

Plant Development (Staging): Muskmelons differ from cucumbers in being andromonoecious rather than monoecious or gynoecious. Andromonoecious plants have staminate (male) and complete flowers on the same plant. Though the complete flowers are self-fertile, self pollination seldom occurs because the pollen is very sticky and bees are required for transfer of pollen. Male flowers generally appear first on the plant and will usually be found on the first 8 to 10 or more nodes. At that time the plant will usually develop some "fruiting" branches which will have complete flowers on their first and second leaf axils. These flowers will usually set fruit. The next series of perhaps 8-10 complete

flowers will abort and then another one or two flowers will set fruits. Varieties vary considerably in the fruit setting pattern. A few plants may set a single fruit quite early and then several flowers later when the "main" crop is set. Some varieties will set only 2 fruits per plant, while others may set and develop 4 or 5 fruits per plant. This makes it very difficult to obtain reliable yield data from 20-plant plots which are usually more than adequate for research with most vegetable crops.

Plant development stages are similar in all vine crops and the following is proposed for muskmelon in the eastern states:

1. Seedling stage up to 2-4 true leaves is usually done in the plant growing area because most melons are transplanted.
2. Vine development stage--up to the first female or complete flower opening which usually ranges from 20 to 30 days from transplanting.
3. Fruit development stage--from fruit setting to first harvest which ranges from 35 to 40 days depending upon temperature conditions; high temperature accelerates development.
4. Fruit harvesting stage--the length of this period is greatly controlled by variety and temperature conditions. Some varieties will ripen all their fruits in 2 weeks, while others may have an extended harvest to abouot 4 weeks.

Hail Effects on Plant Development and Yield:

The hail simulation was generally very effective in causing injury to foliage, stems and fruits which appeared similar to actual hail injury in 1989 and 1990. In 1991, we were unable to obtain crushed ice to blow on the plants and could only obtain ice chunks which were larger than the crushed ice and did not defoliate the plants as well. It tended to break off whole leaves and stems

rather than shred them.

Also, in 1991 we changed varieties from the large fruited Super Star to Gold Star which produces smaller fruits. This was done to try to obtain more reliable and uniform yield data; i.e., a single large fruit has more impact on yield than a single smaller fruit, and smaller fruited varieties tend to have less plant to plant yield variability. However, this did not appear to be the case because when one examines the combined data, differences are extremely difficult to ascertain (Fig. 1). This was especially frustrating because the plants with moderate to severe defoliation prior to fruit set, were noticeably delayed in development. It was, for all practical purposes, impossible to see this response from the several types of analyses of the data there were conducted. Data on total yields for each season (Fig. 2,3,4) also show no effect of defoliation on yield of marketable fruit.

Analysis by harvest of the 1989 data do suggest that defoliation prior to significant fruit set, did delay fruit development as indicated by reduced yields the first and second harvest and higher yields at the final harvest as defoliation from hail increased (Fig. 5-9). Results are somewhat similar for 1990 and 1991 if the first harvest is ignored (Fig. 10-29). The range of defoliation was much less in 1991 than previous years. This likely had some influence on the results.

Results from this study clearly demonstrate the ability of muskmelon to recover from rather severe hail injury and produce total yields comparable to uninjured crops. However, the harvest period must be sufficiently long for the plants to recover from the injury. The data suggest that it takes up to 4 weeks for the plants to recover and produce yields comparable to uninjured crops. The length of time appears associated with severity of defoliation, but that is not

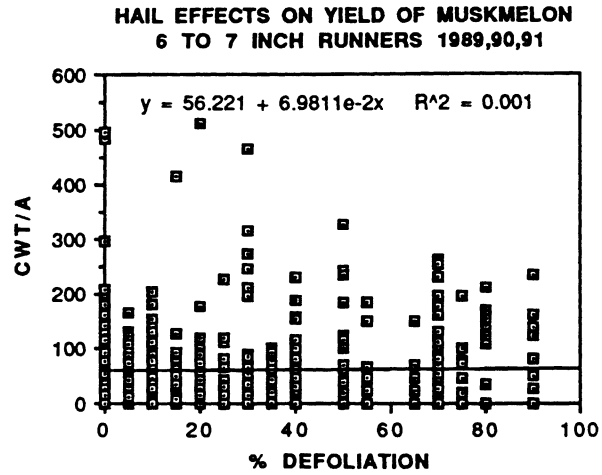
very clear-cut.

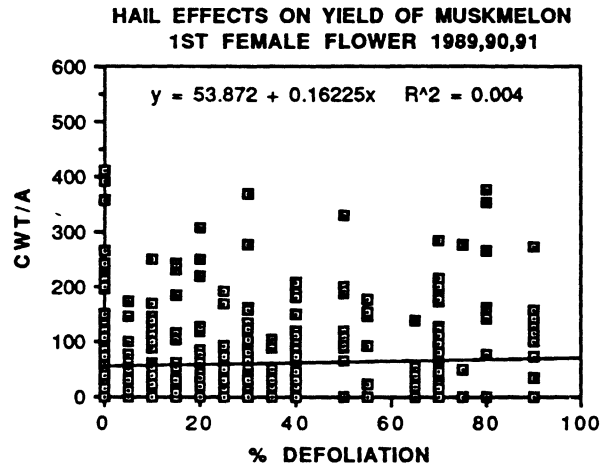
Economic losses may be significant, however, because the earliest fruits are usually the highest value. When major production develops, prices usually decline and they may not increase until the season is nearly over and quantity again becomes limited. Fig. 30 is included to provide information on economic status for muskmelon under Ohio conditions.

Plant Stand Effects on Yield:

Results from the study of plant stand are summarized in Fig. 31 & 32. Muskmelon tends to be somewhat like tomato in that adjacent plants compensate for missing plants. Furthermore, varieties do not respond the same to plant spacings. The large fruited variety Super Star planted in 1989 and 1990 had lower yields at the 100% stand than at the 75 or 90% stands, and in 1990 the 50% stand had yields similar to the 75 and 90% stand treatments.

Results do suggest that in general a 10% loss of stand will have no adverse effects on yield and with large fruited types it is likely that even a 25% stand loss will not result in a significant loss of yield.





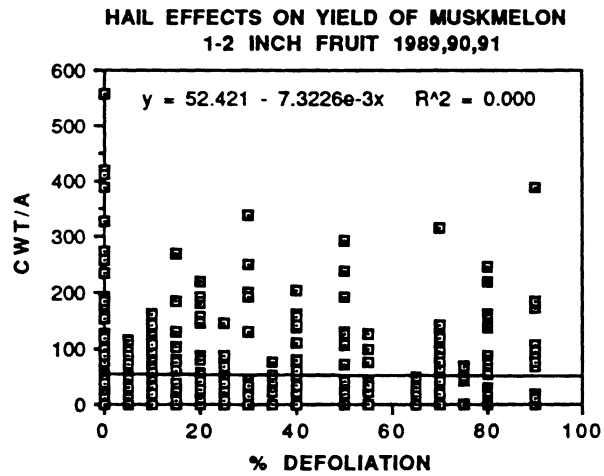
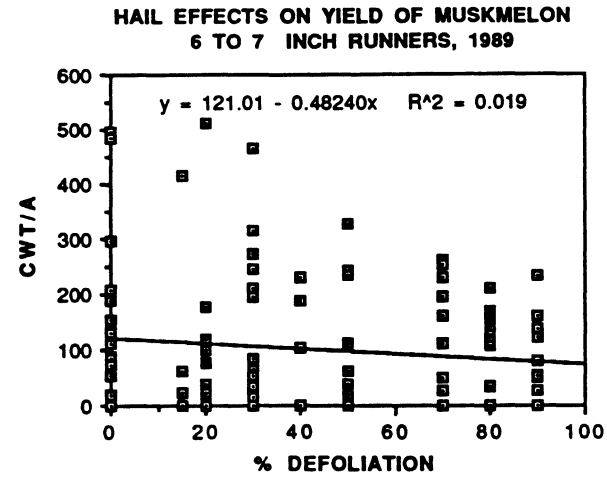
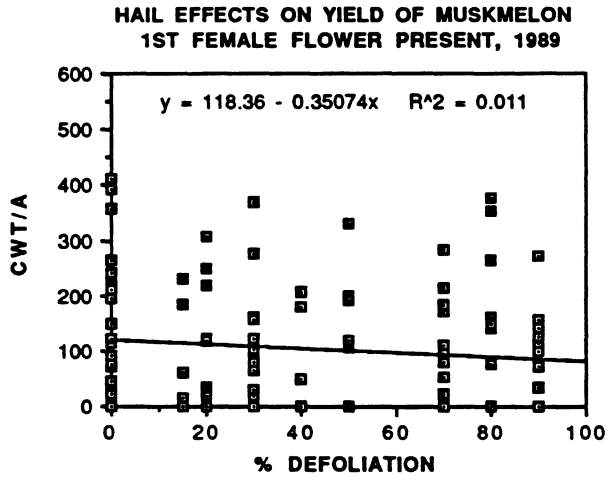


Figure 1. Influence of defoliation from simulated hail at 3 stages of plant development on total yield of marketable muskmelon for 3 seasons, 1989, 90 and 91.





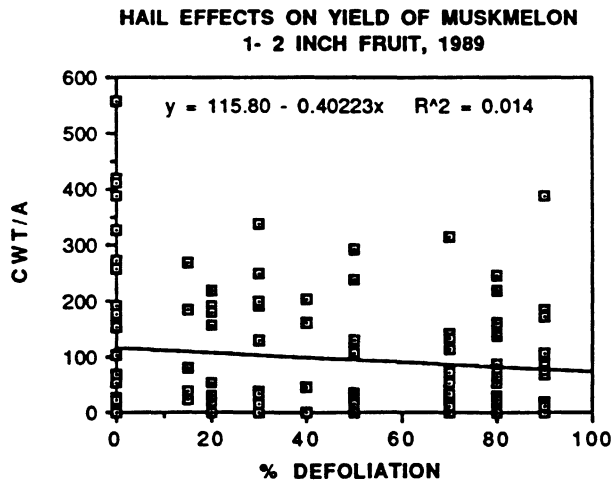
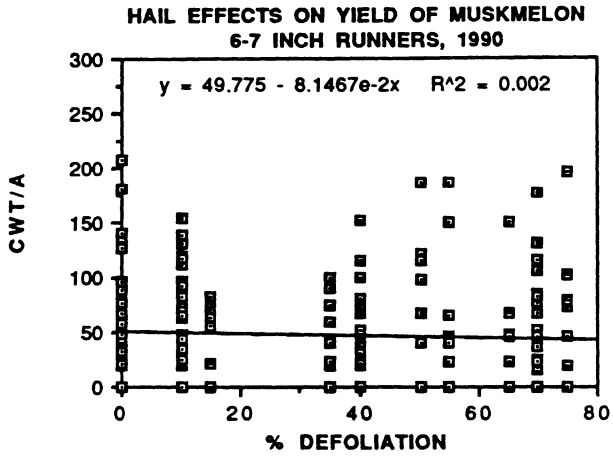
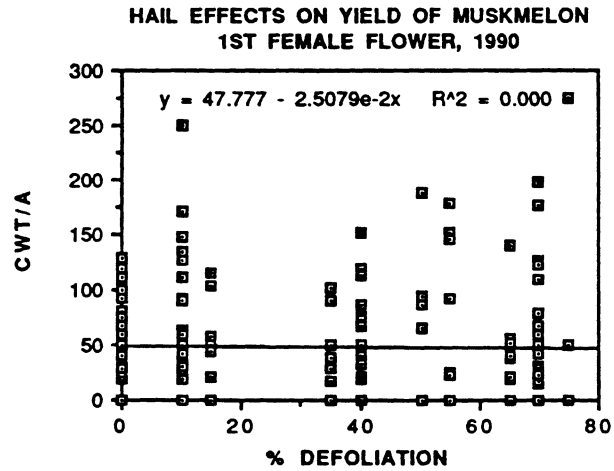


Figure 2. Influence of defoliation from simulated hail at 3 stages of plant development on total yield of marketable muskmelon for the 1989 season.





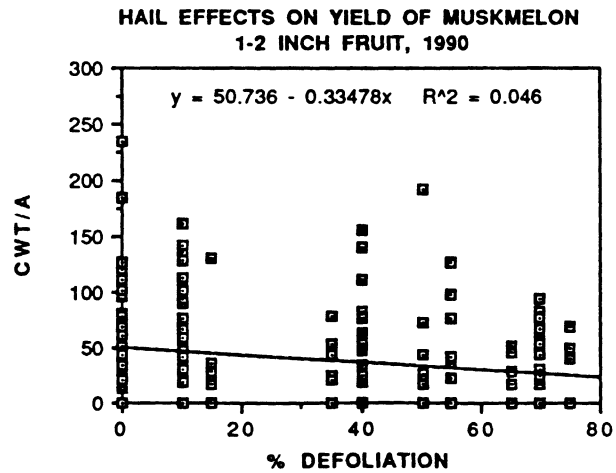
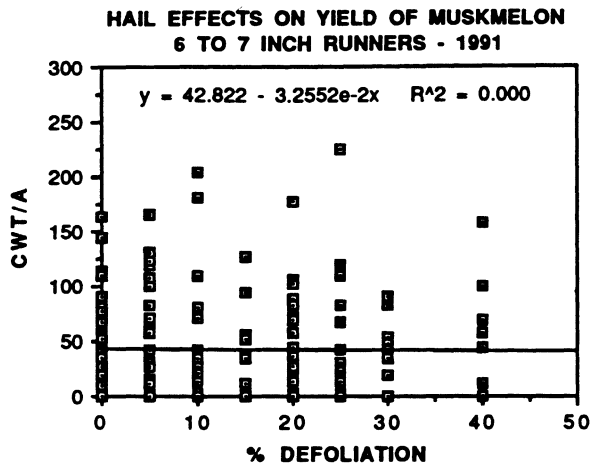
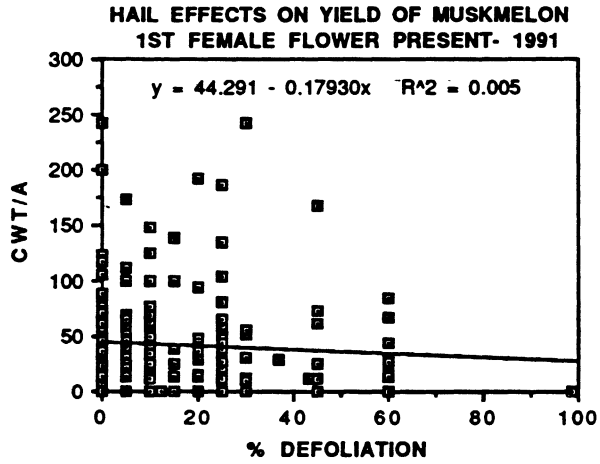


Figure 3. Influence of defoliation from simulated hail at 3 stages of plant development on total yield of marketable muskmelon for the 1990 season.





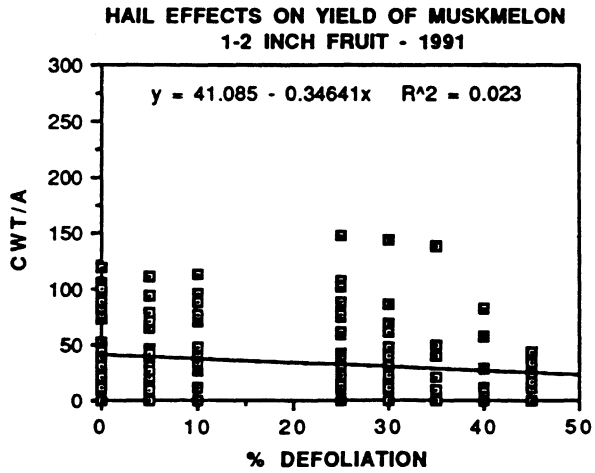


Figure 4. Influence of defoliation from simulated hail at 3 stages of plant development on total yield of marketable muskmelon for the 1991 season.

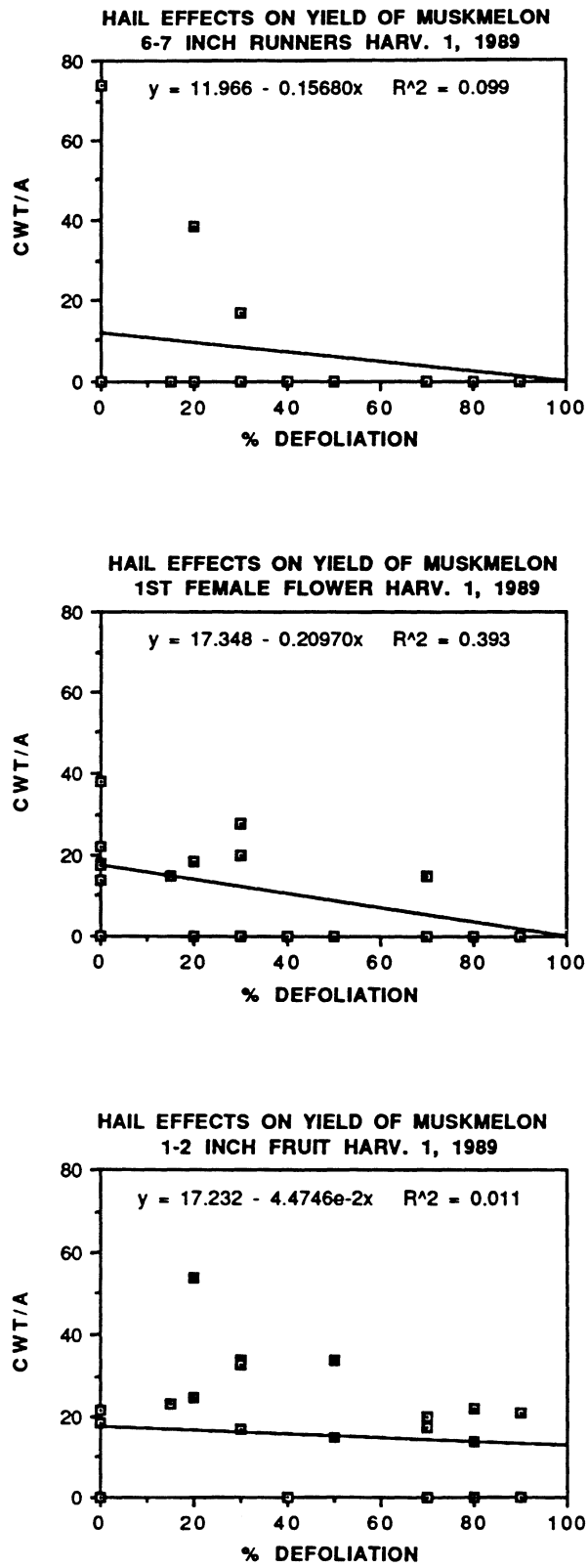
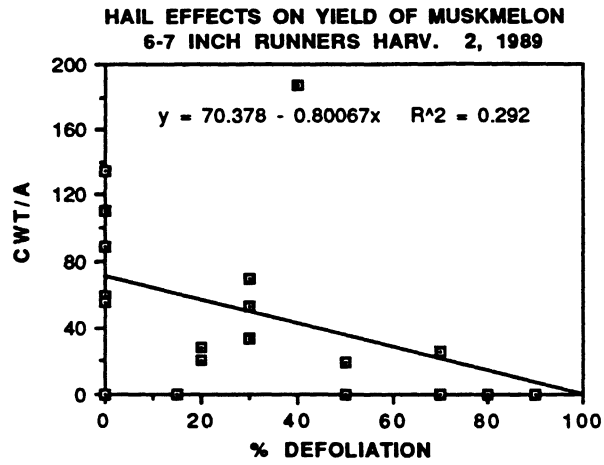
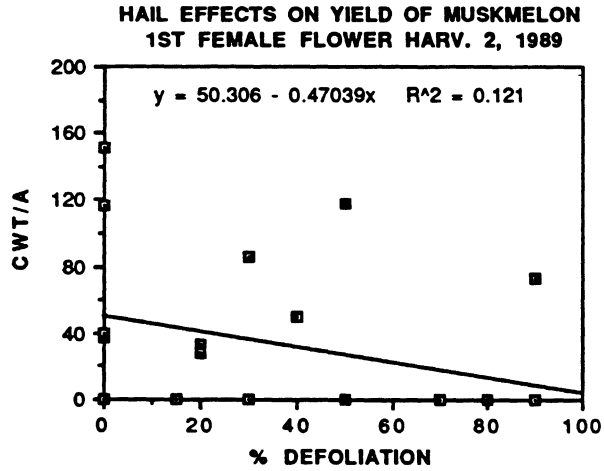


Figure 5. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the first harvest, 1989.





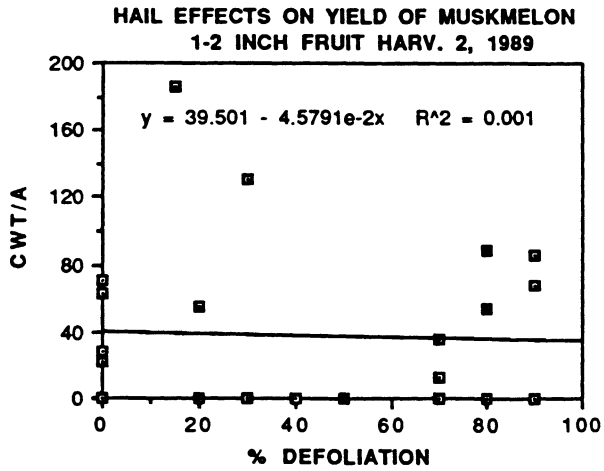
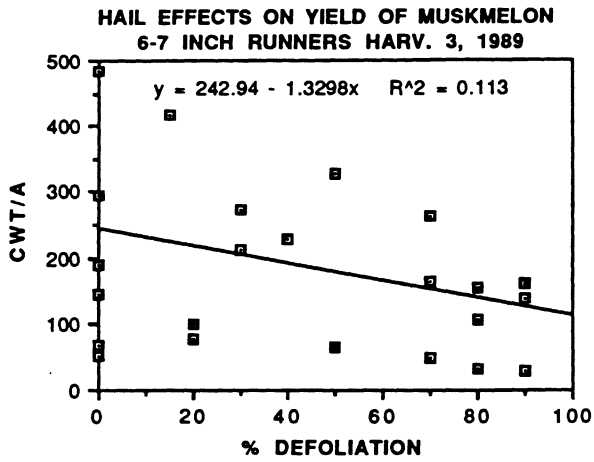
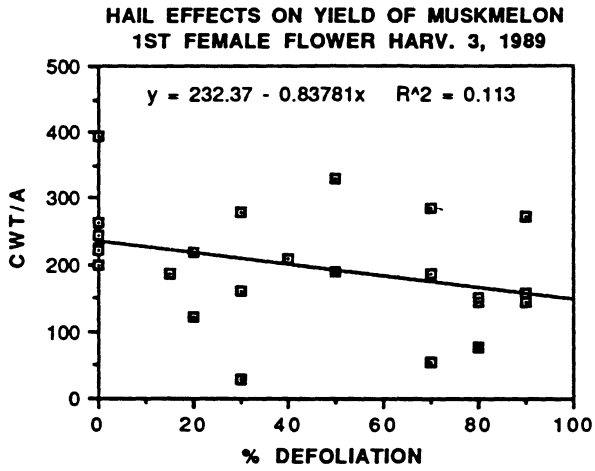


Figure 6. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the second harvest, 1989.





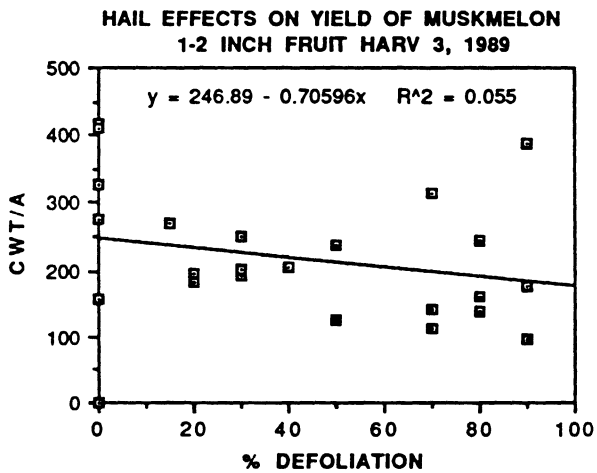
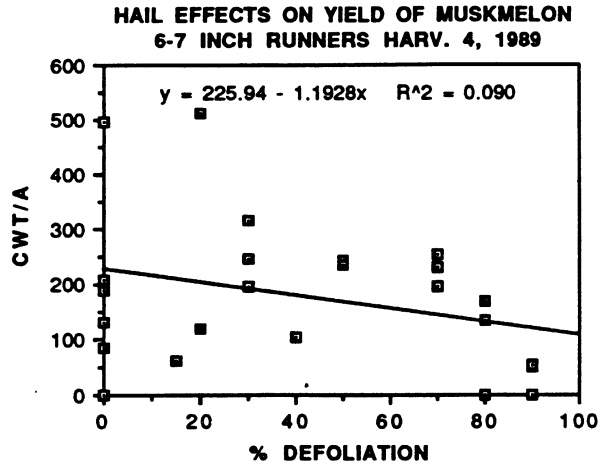
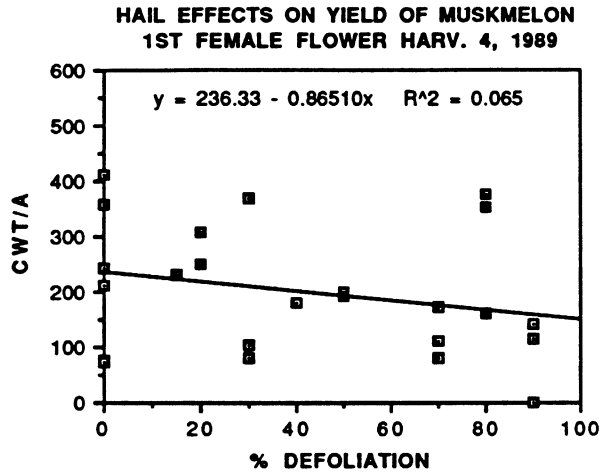


Figure 7. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the third harvest, 1989.





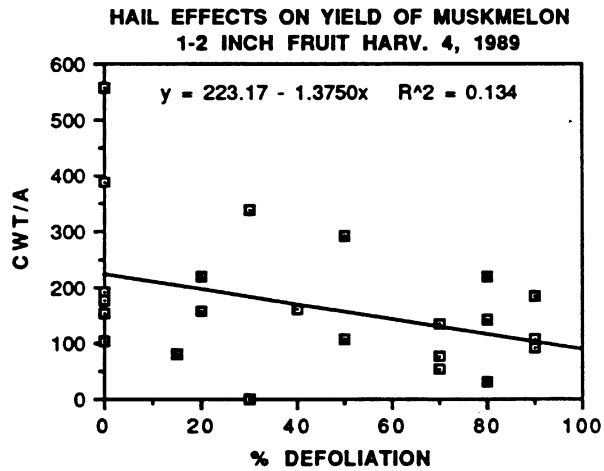
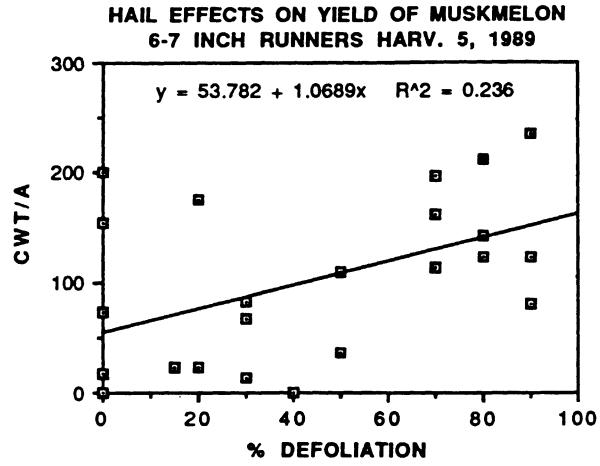
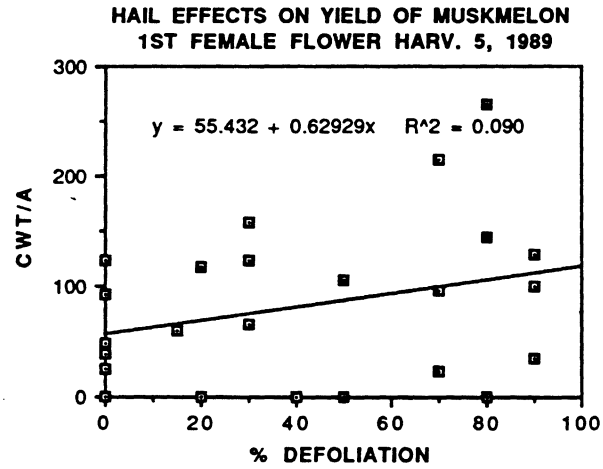


Figure 8. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the fourth harvest, 1989.





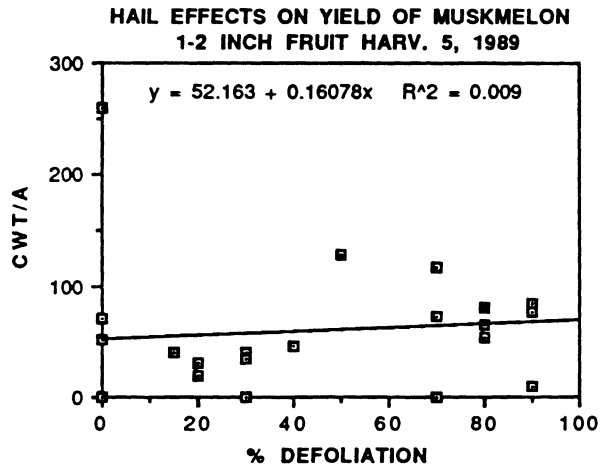


Figure 9. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the fifth harvest, 1989.

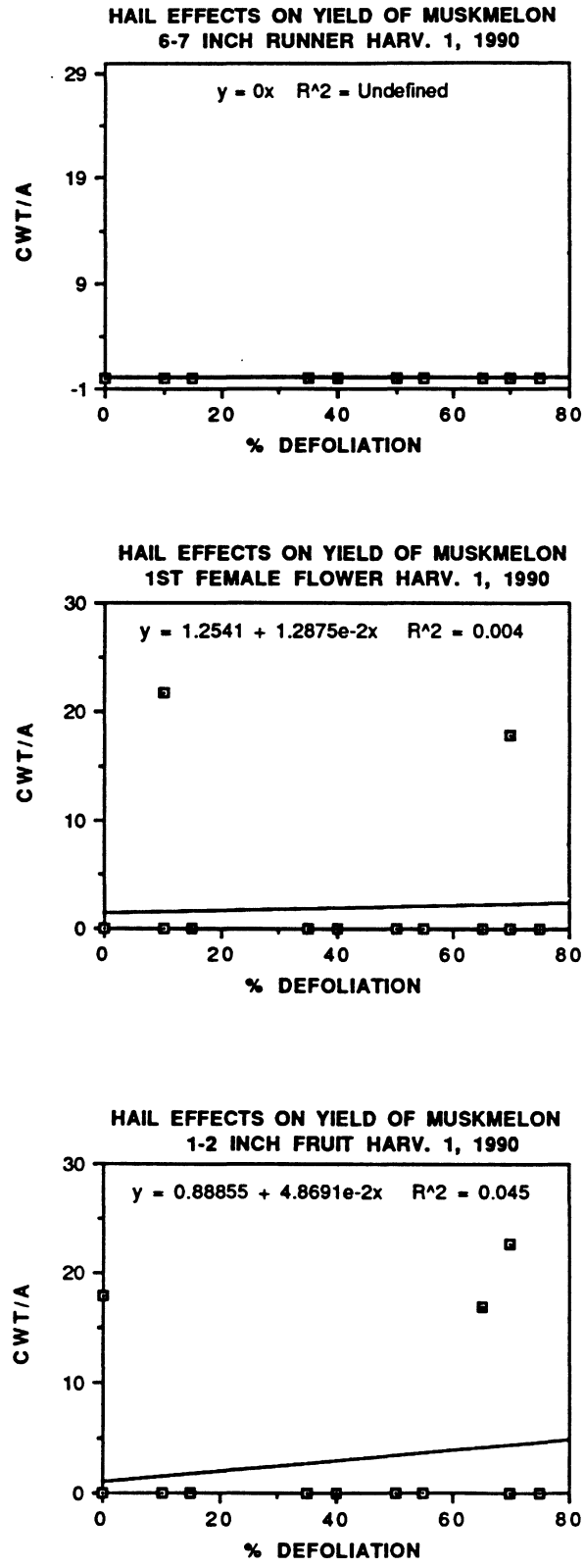
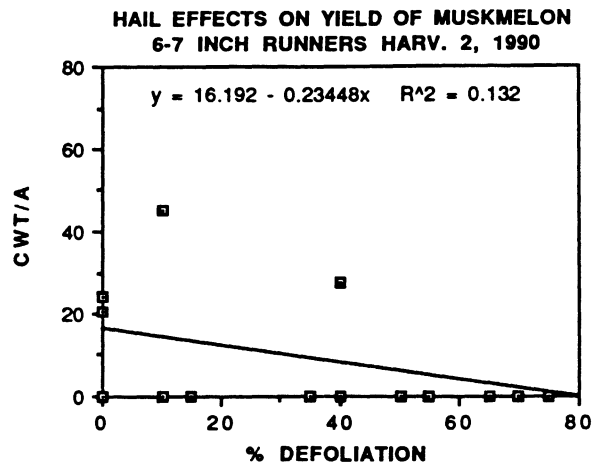
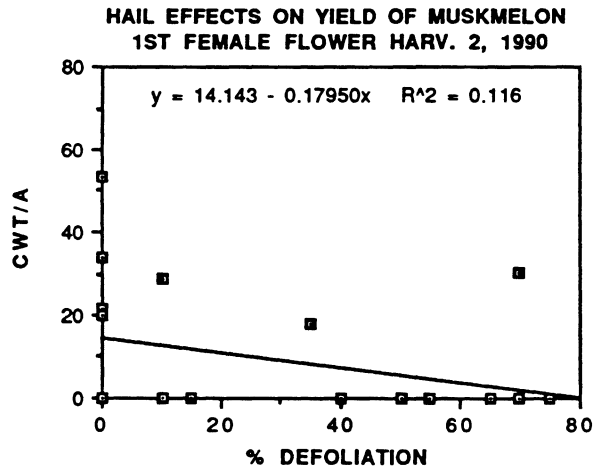


Figure 10. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the first harvest, 1990.





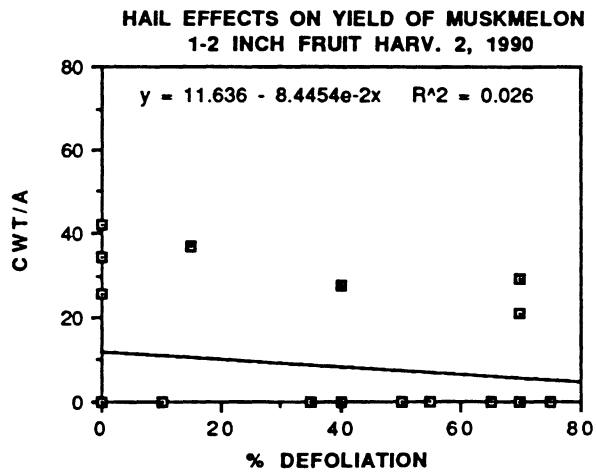
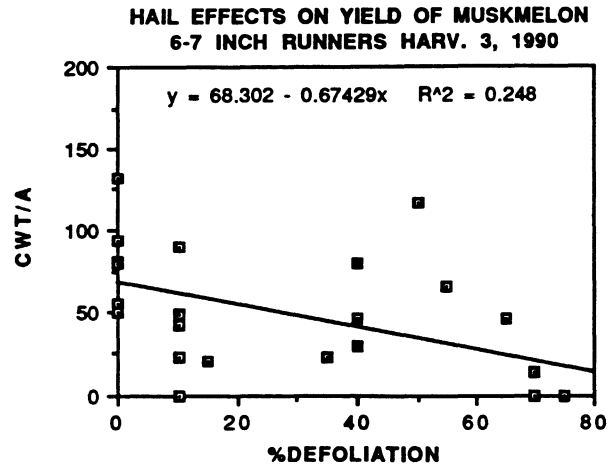
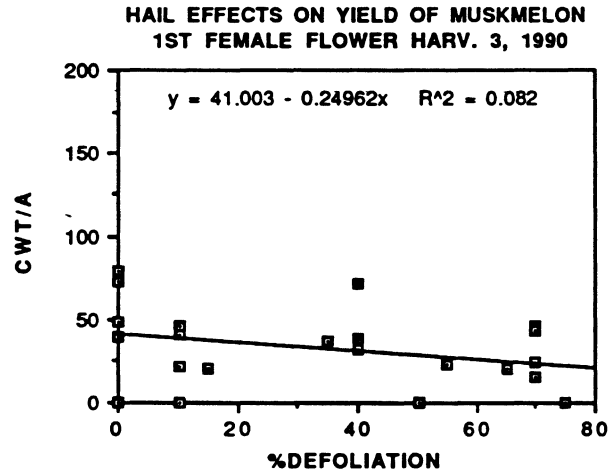


Figure 11. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the second harvest, 1990.





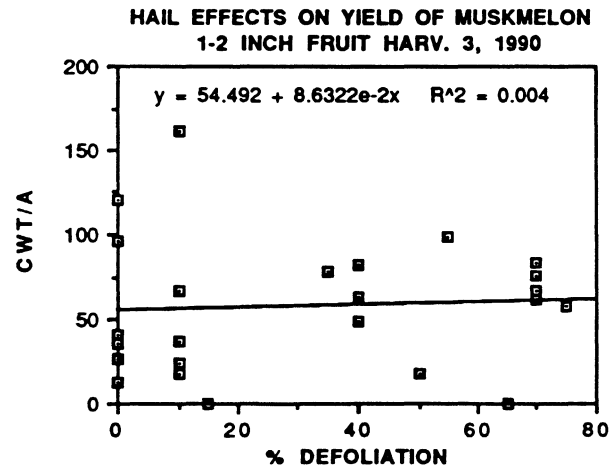
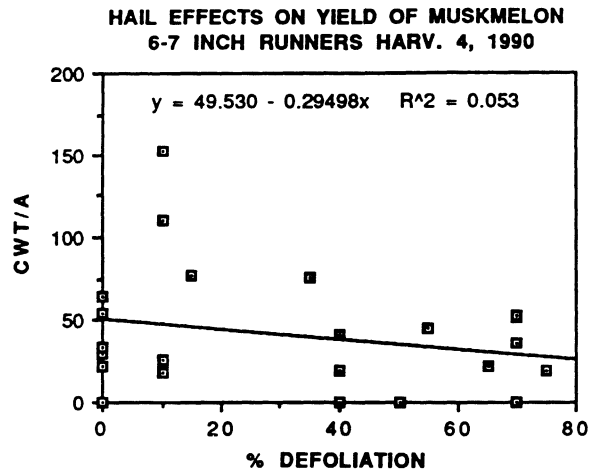
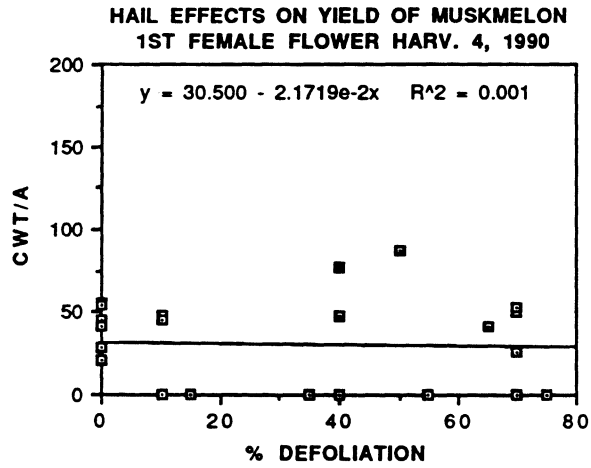


Figure 12. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the third harvest, 1990.





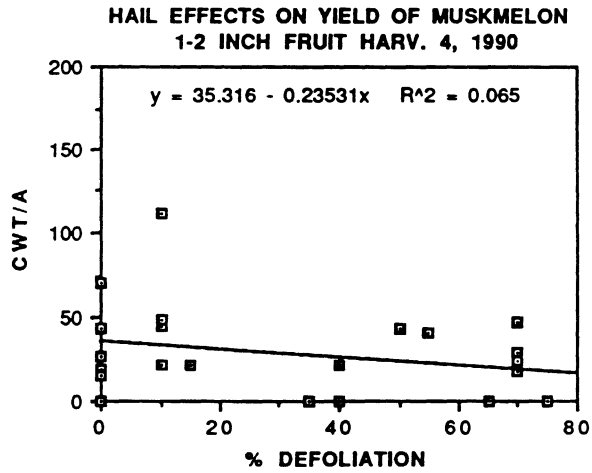
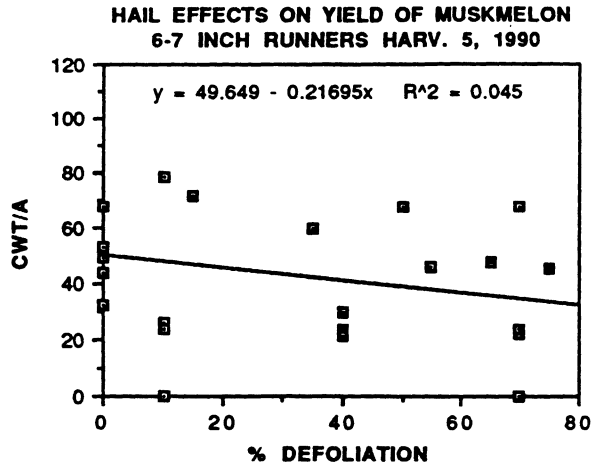
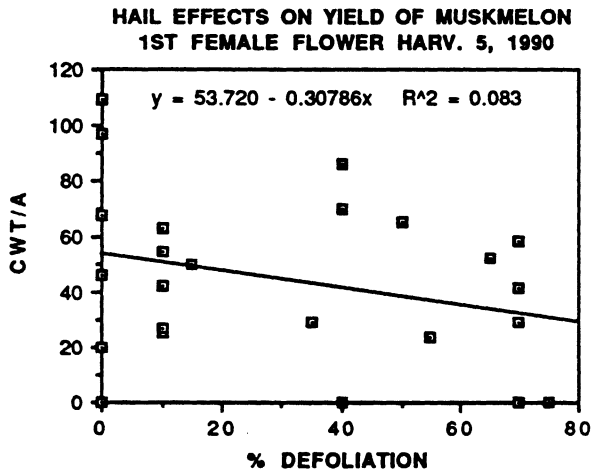


Figure 13. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the fourth harvest, 1990.





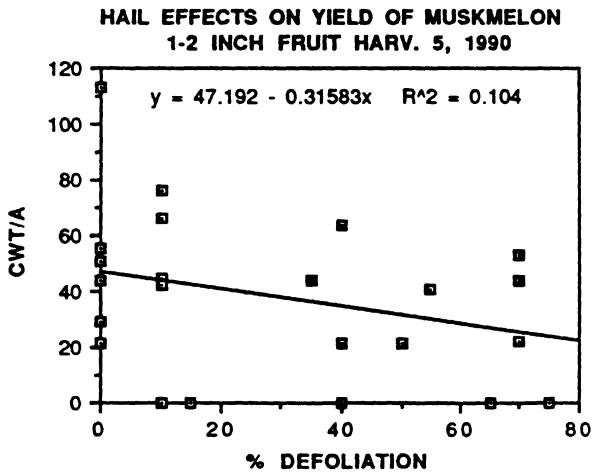
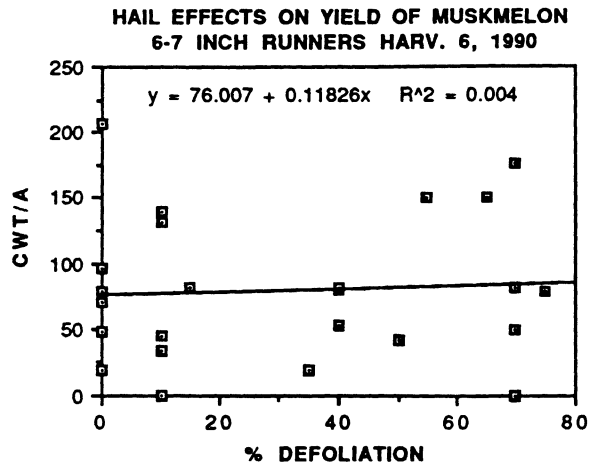
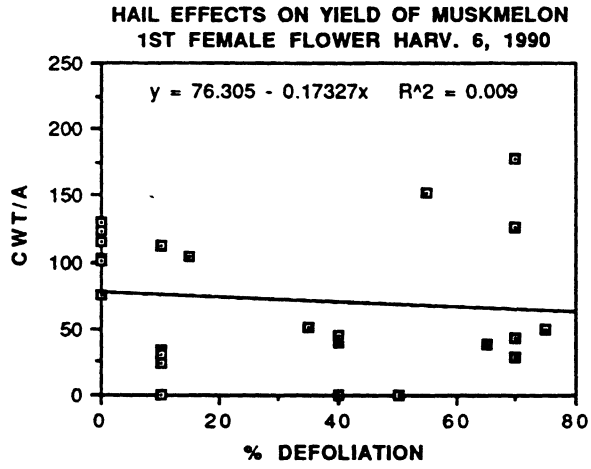


Figure 14. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the fifth harvest, 1990.





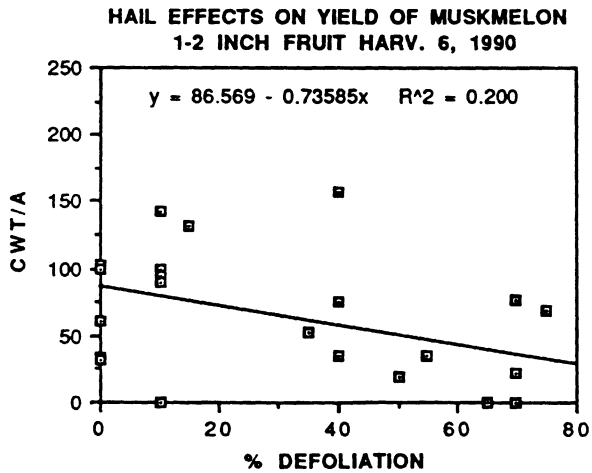
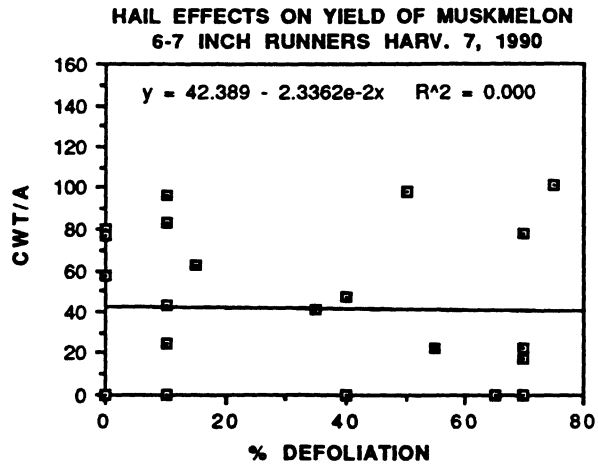
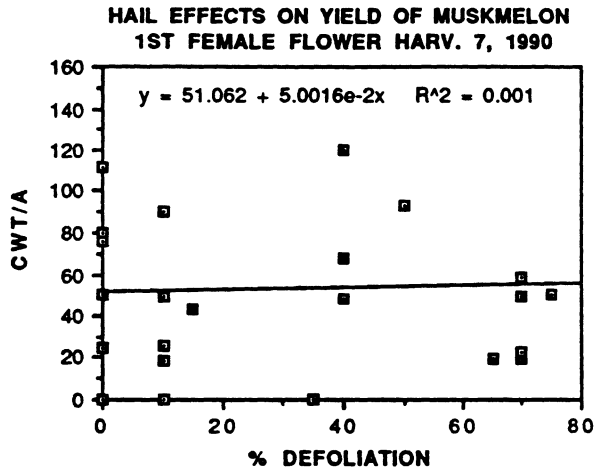


Figure 15. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the sixth harvest, 1990.





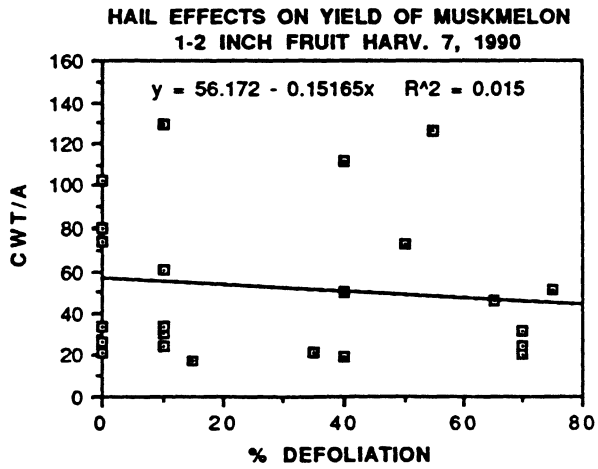
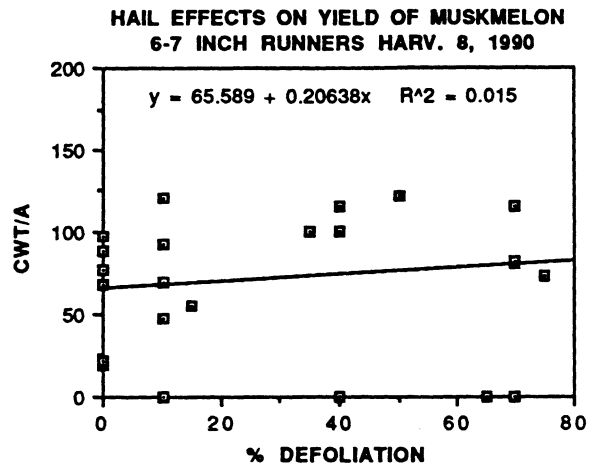
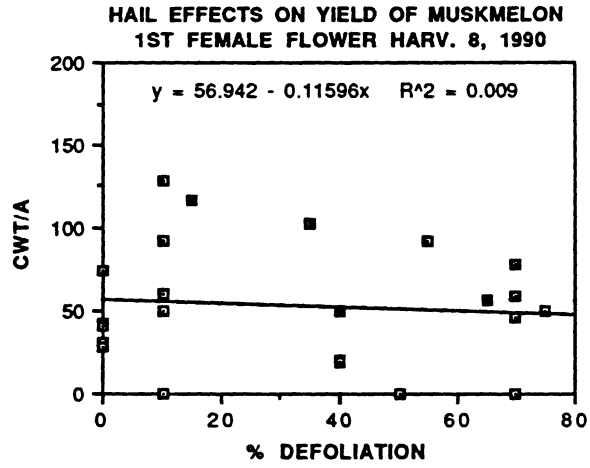


Figure 16. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the seventh harvest, 1990.





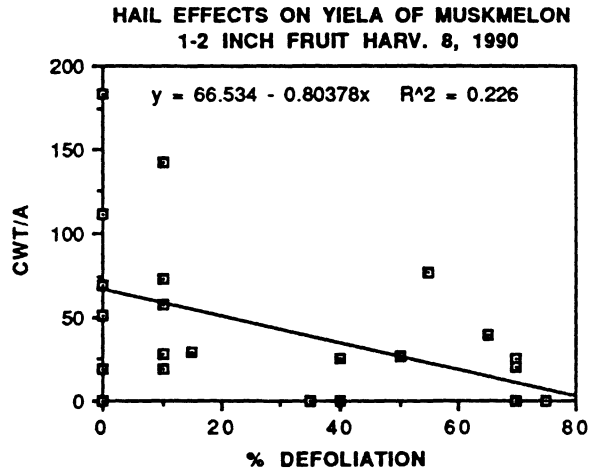
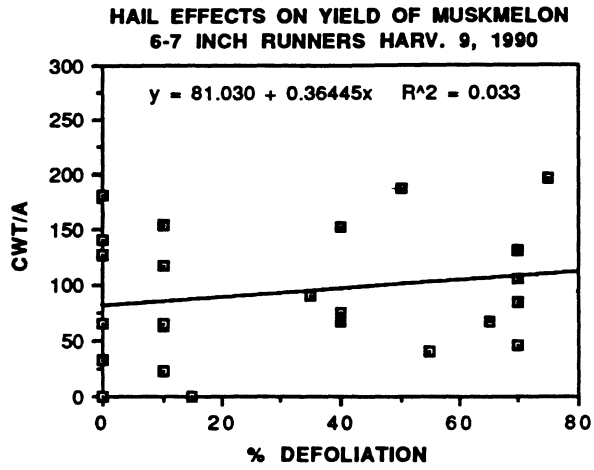
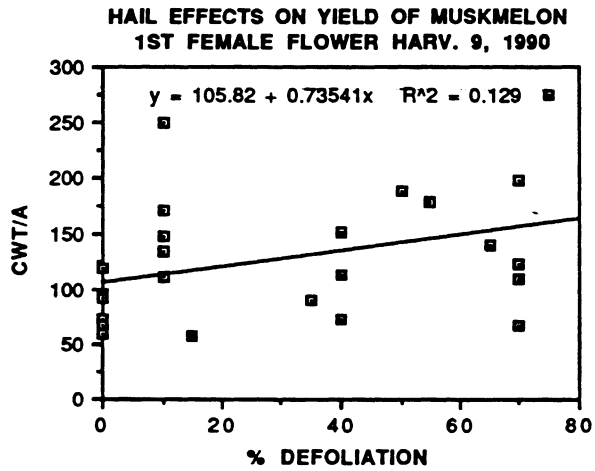


Figure 17. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the eighth harvest, 1990.





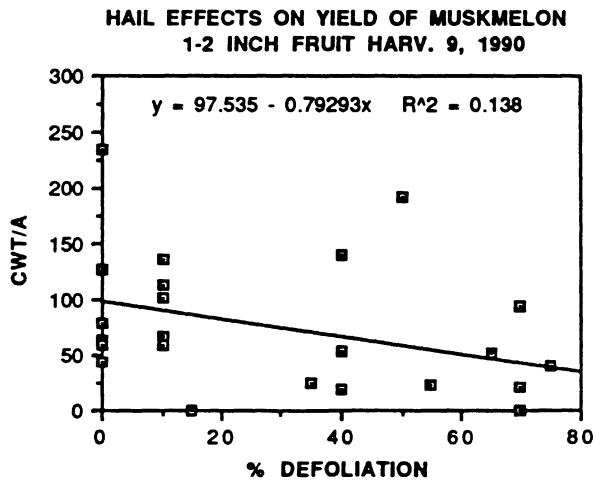
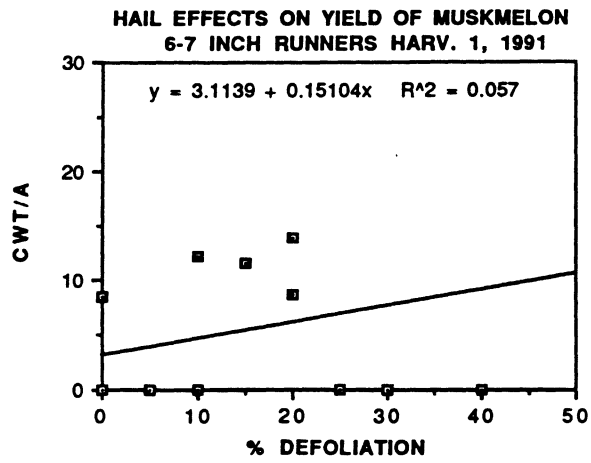
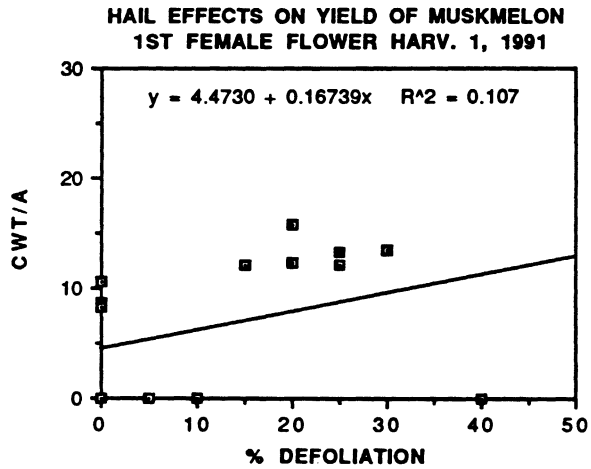


Figure 18. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the ninth harvest, 1990.





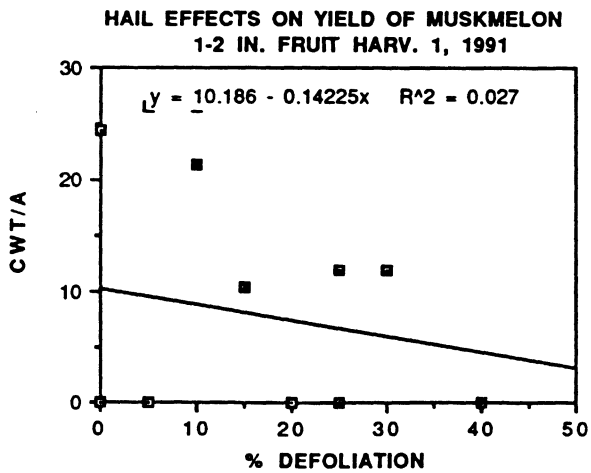
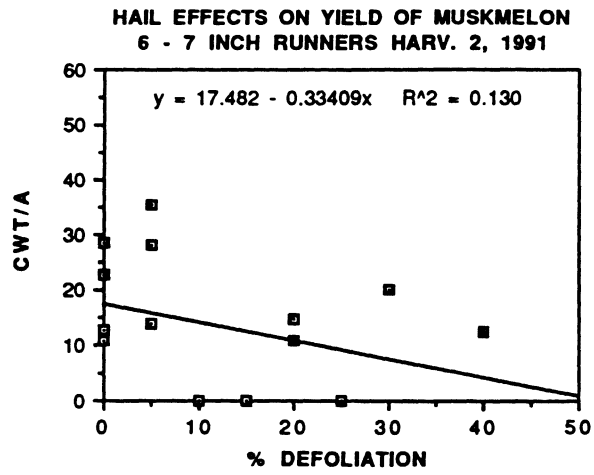
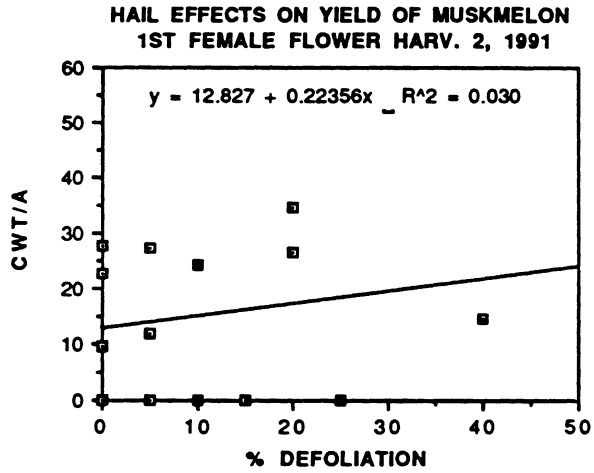


Figure 19. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the first harvest, 1991.





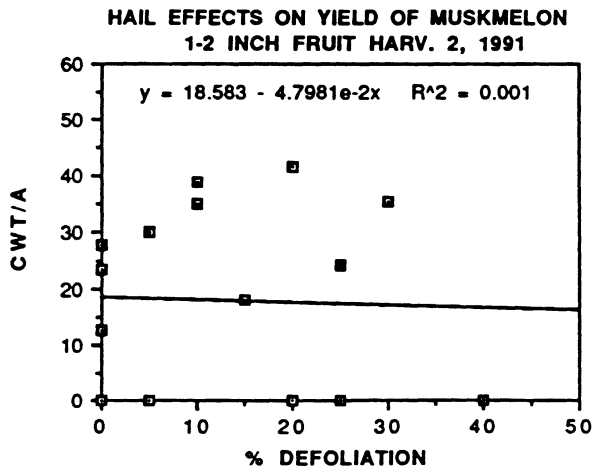
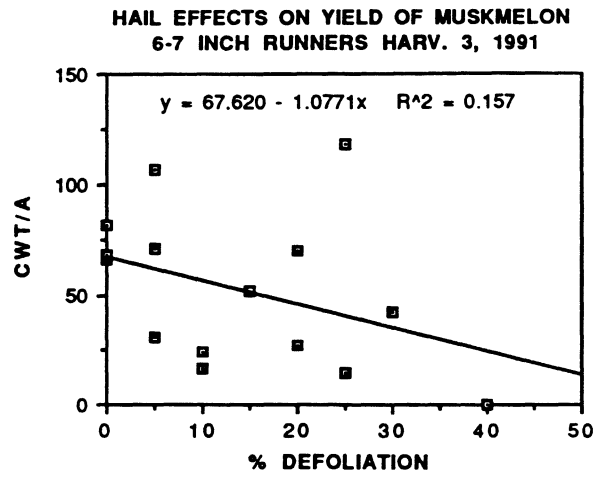
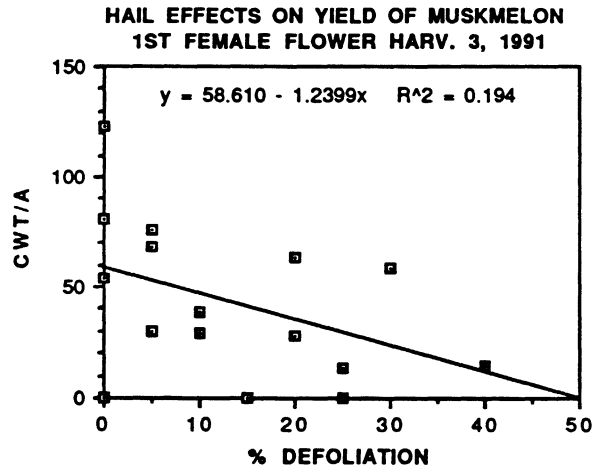


Figure 20. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the second harvest, 1991.





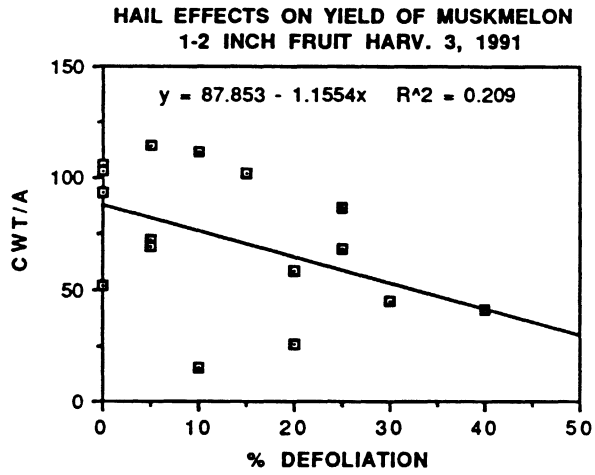
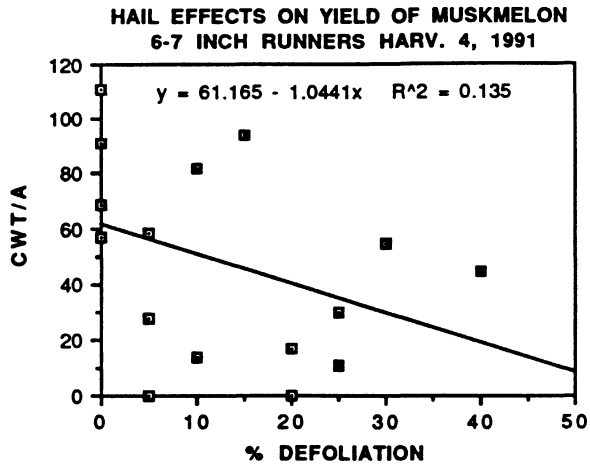
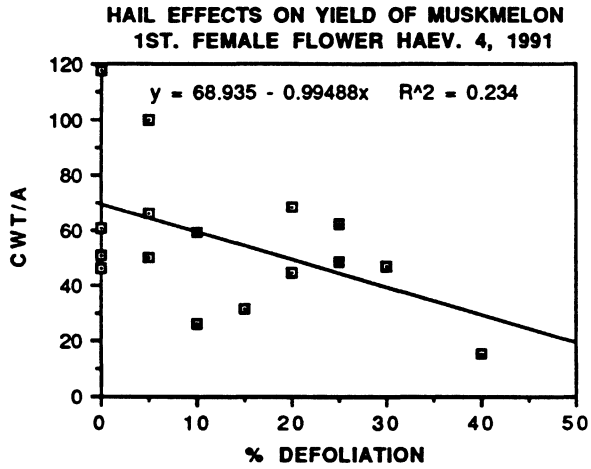


Figure 21. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the third harvest, 1991.





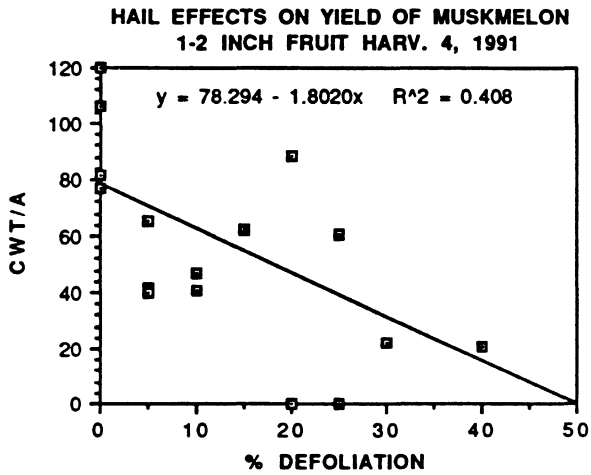
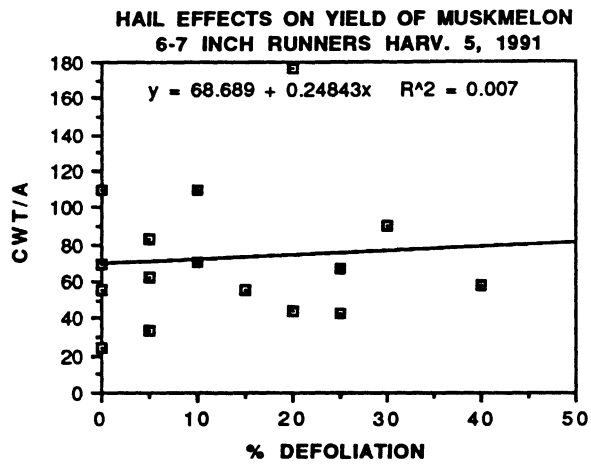
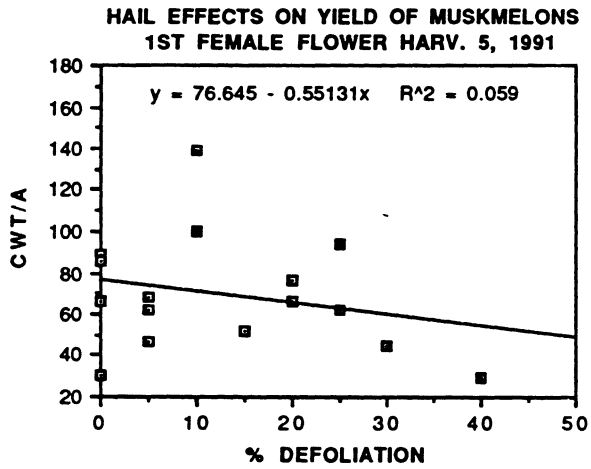


Figure 22. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the fourth harvest, 1991.





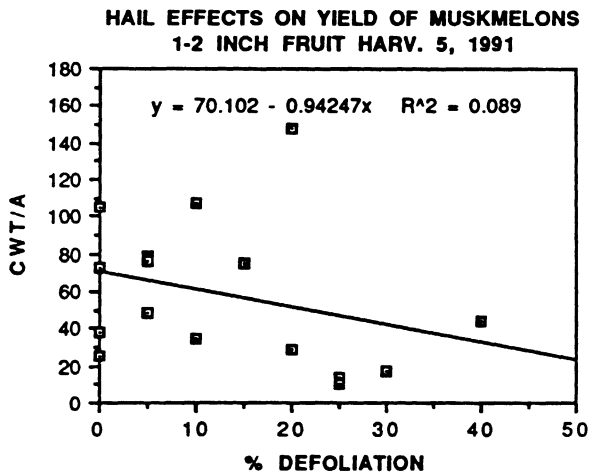
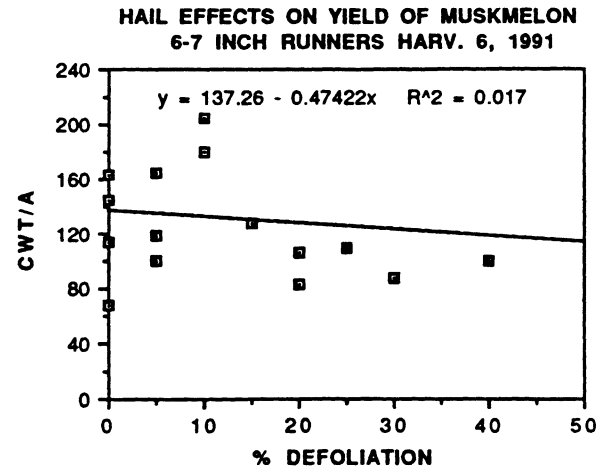
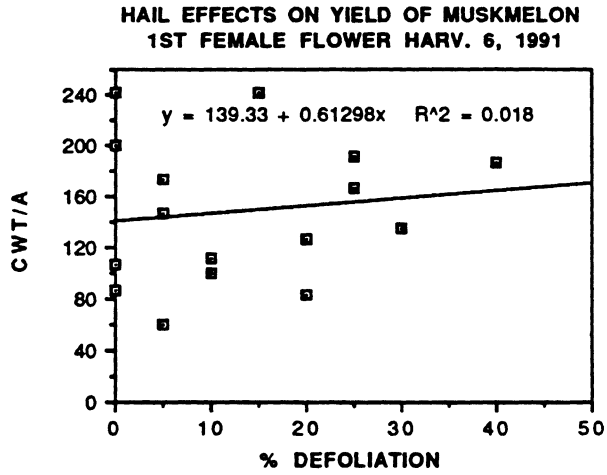


Figure 23. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the fifth harvest, 1991.





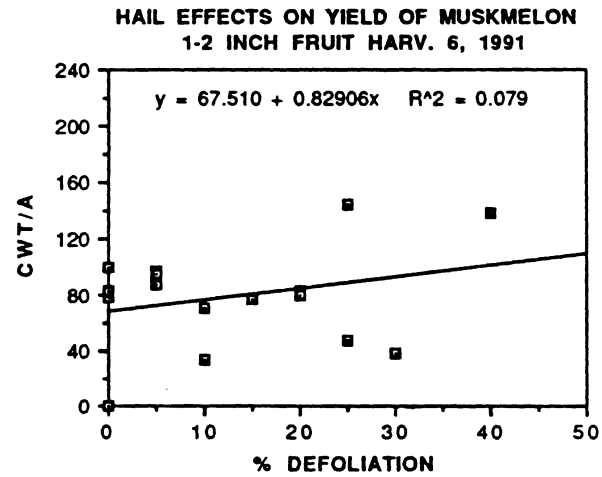
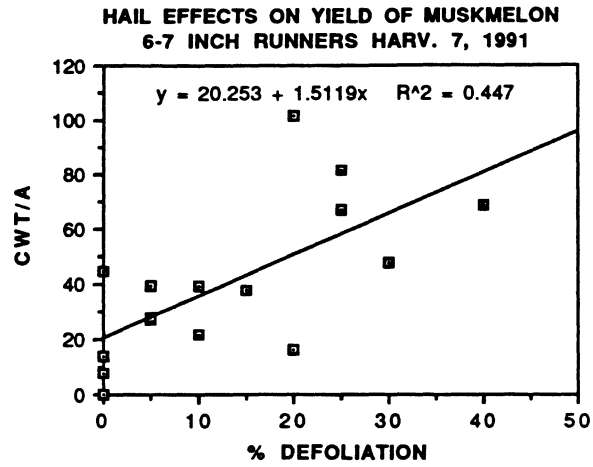
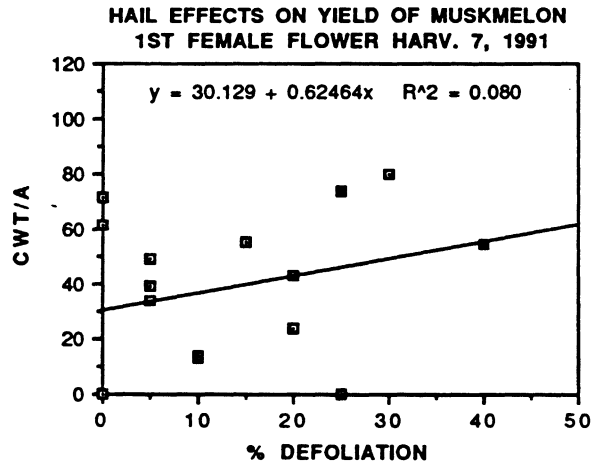


Figure 24. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the sixth harvest, 1991.





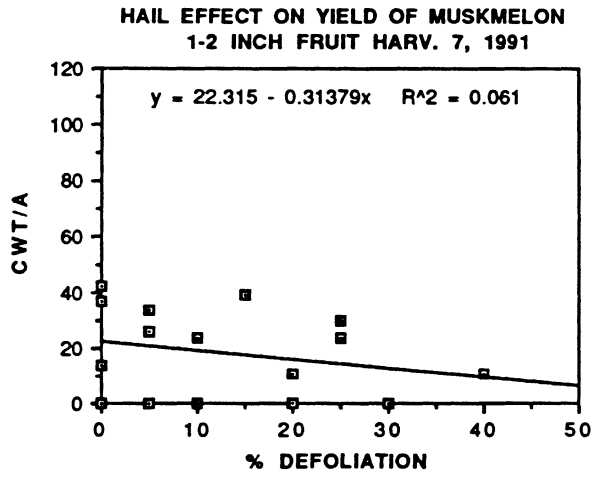
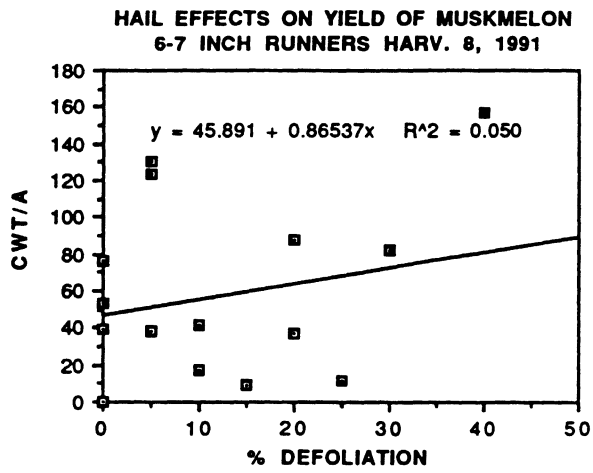
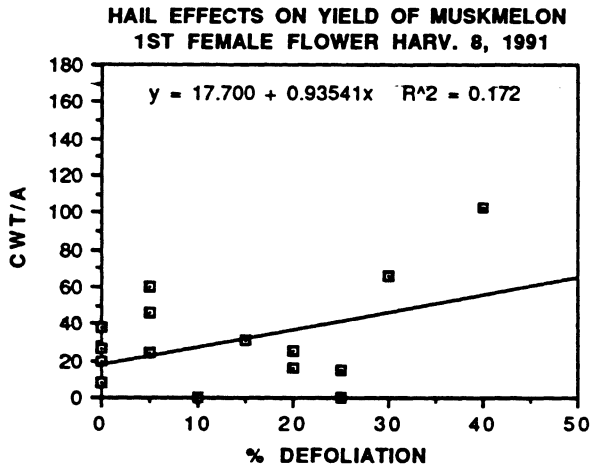


Figure 25. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the seventh harvest, 1991.





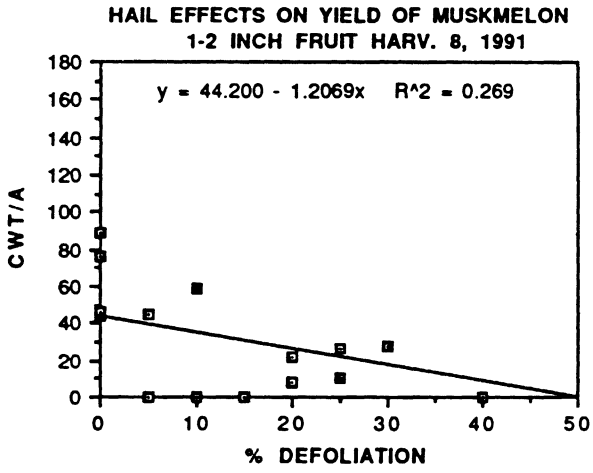
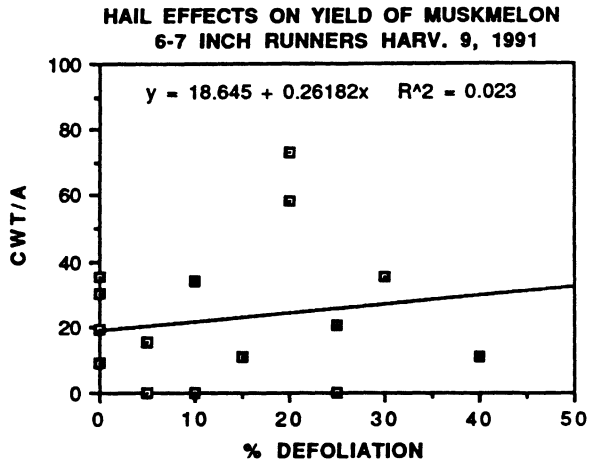
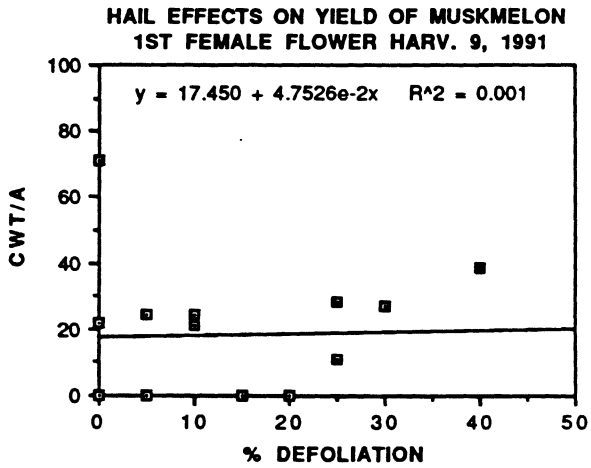


Figure 26. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the eighth harvest, 1991.





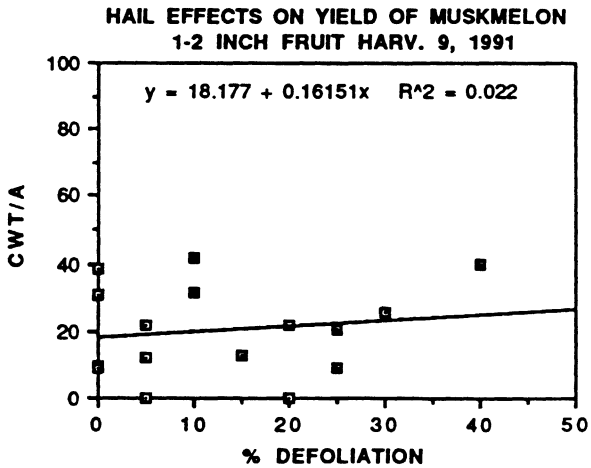
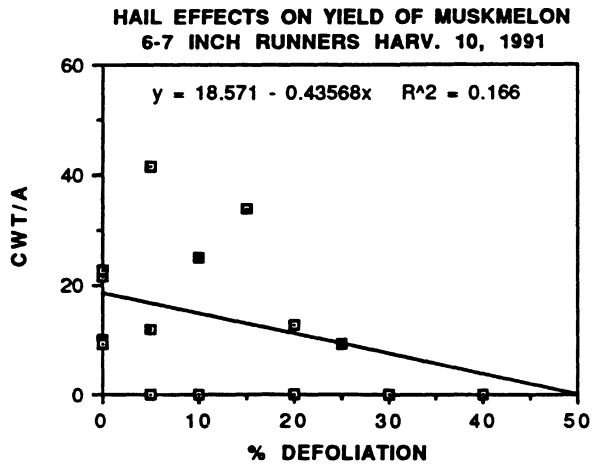
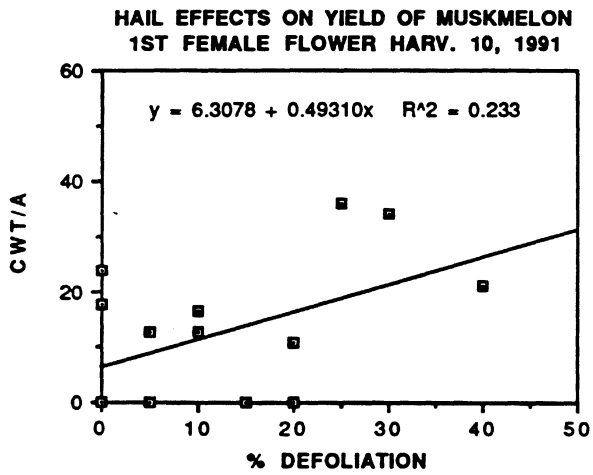


Figure 27. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the ninth harvest, 1991.





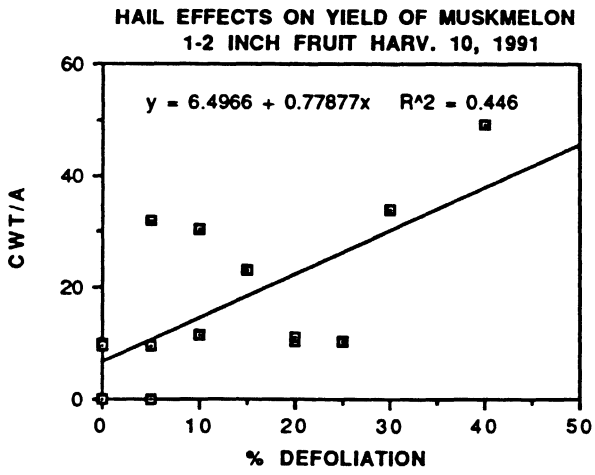
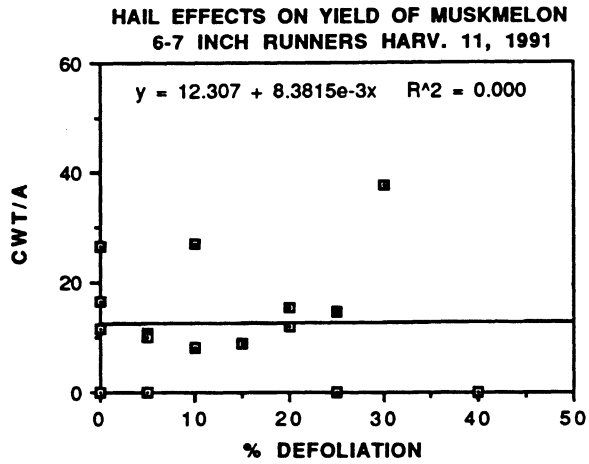
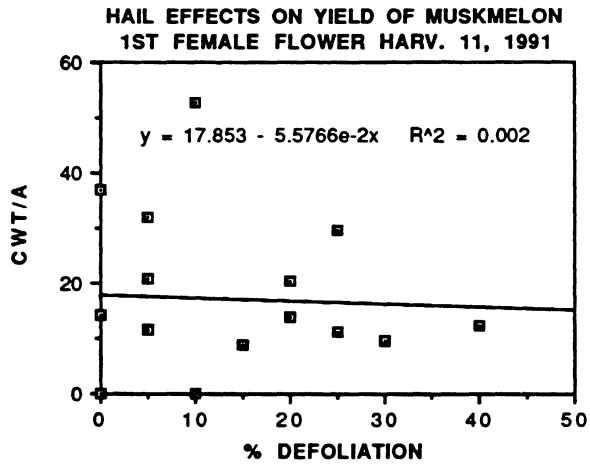


Figure 28. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the tenth harvest, 1991.





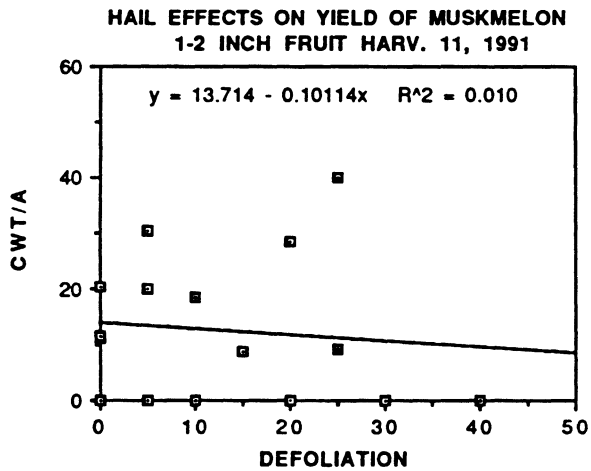


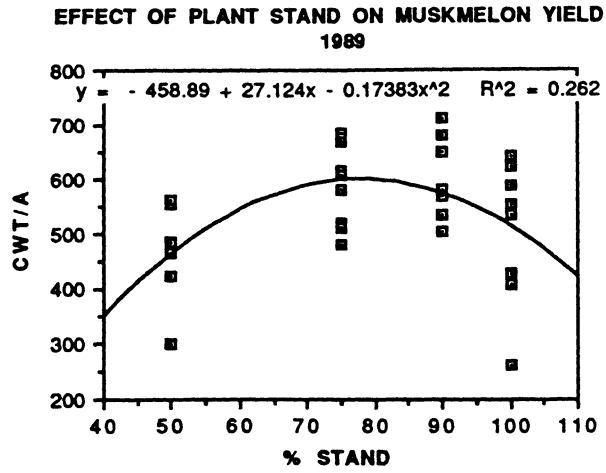
Figure 29. Influence of defoliation from simulated hail at 3 stages of plant development on yield of marketable muskmelon from the eleventh harvest, 1991.

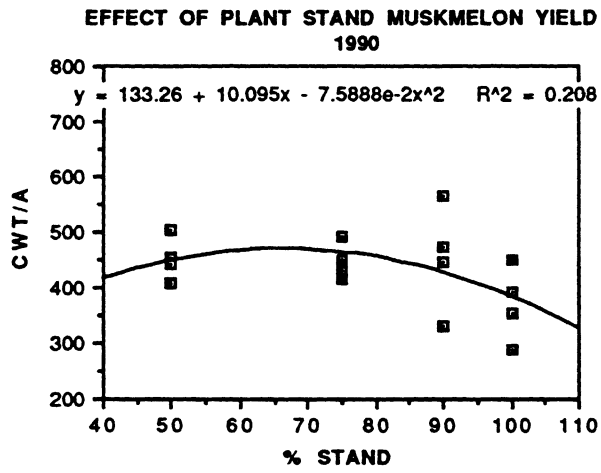
1989 MUSKMELON - FRESH MARKET

ITEM	EXPLANATION	PRICE PER UNIT	YIELD/ACRE (bu./A) 200	300	400	YOUR BUDGET
RECEIPTS		$6.00/bu	$1,200	$1,800	$2,400	$_____
VARIABLE COSTS						
Seed	0.5 lb	$180/lb	$ 90	$ 90	$ 90	$_____
Jiffy 7's	2000	$ 57/1000	$ 114	$ 114	$ 114	$_____
Fertilizer						
N	50 lbs	$0.21/lb	$ 11	$ 11	$ 11	$_____
P2O5	200 lbs	$0.23/lb	$ 46	$ 46	$ 46	$_____
K2O	200 lbs	$0.11/lb	$ 22	$ 22	$ 22	$_____
Lime	1000 lbs	$12.80/T	$ 6	$ 6	$ 6	$_____
Pesticides[1]						
Herbicide						
Alanap	1.5 gal	$13.40/gal	$ 20	$ 20	$ 20	$_____
Prefar	1 gal	$31/gal	$ 31	$ 31	$ 31	$_____
Fungicide						
Benlate	4 lbs	$13.50/lb	$ 54	$ 54	$ 54	$_____
Bravo	4 gal	$35.90/gal	$ 144	$ 144	$ 144	$_____
Insecticide						
Thiodan	2 gal	$32/gal	$ 64	$ 64	$ 64	$_____
Sevin	14 lbs	$2.70/lb	$ 38	$ 38	$ 38	$_____
Plastic mulch	6000 ft	$0.03/ft	$ 180	$ 180	$ 180	$_____
Containers	200 300 400	$1.35/bskt	$ 270	$ 405	$ 540	$_____
Hired Labor(hr)	50 60 70	$5.50/hr	$ 275	$ 330	$ 385	$_____
Fuel, Oil, Grease			$ 45	$ 45	$ 45	$_____
Repairs			$ 33	$ 33	$ 33	$_____
Miscellaneous			$ 20	$ 20	$ 20	$_____
Int.on Oper.Cap.[2]	5 mo	10%	$ 30	$ 34	$ 38	$_____
TOTAL VARIABLE COSTS		- per acre	$1,493	$1,687	$1,881	$_____
		- per bushel	$7.47	$5.62	$4.70	$_____
FIXED COSTS						
Labor Charge	70 hrs	$6/hr	$ 420	$ 420	$ 420	$_____
Mach. & Equip Charge			$ 325	$ 325	$ 325	$_____
Land Charge	Rent		$ 95	$ 95	$ 95	$_____
Management Charge	5% of Gross		$ 60	$ 90	$ 120	$_____
TOTAL FIXED COSTS			$ 900	$ 930	$ 960	$_____
TOTAL COSTS		- per acre	$2,393	$2,617	$2,841	$_____
		- per bushel	$11.97	$8,72	$7,10	$_____
RETURN ABOVE VARIABLE COSTS			($293)	$113	$519	$_____
RETURN ABOVE TOTAL COSTS			($1,193)	($817)	($441)	$_____

[1]Other pesticides are labeled for this crop. Check Bulletin 672 for other recommended pesticides.
[2]Based of 1/2 of total variable expenses for 5 months at 10% interest.

Figure 30. Muskmelon production budget from Ohio State Farm Management Extension.





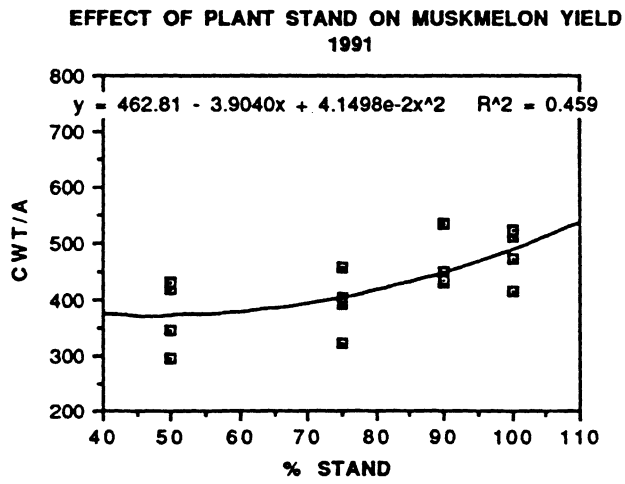
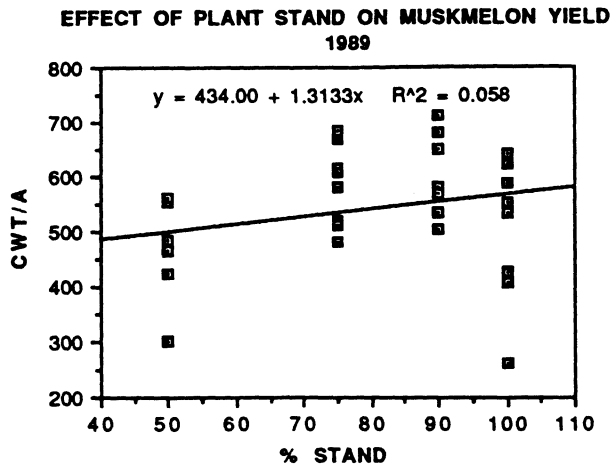
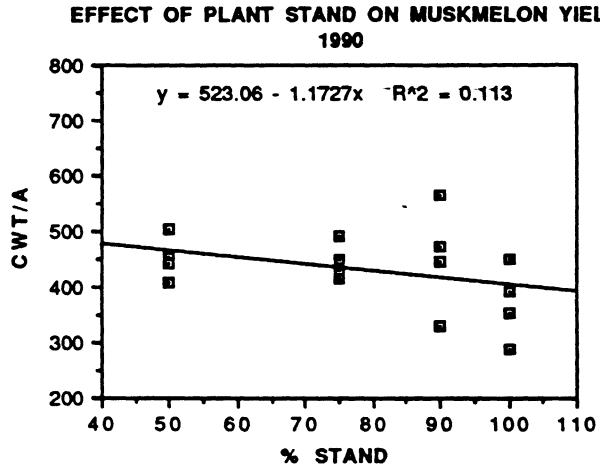


Figure 31. Effect of plant stand on production of muskmelon, 1989, 1990, 1991 - quadratic relationship.





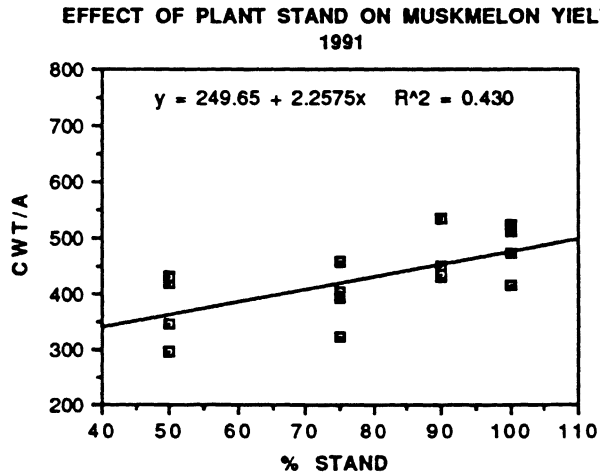


Figure 32. Effect of plant stand on production of muskmelon, 1989, 1990, 1991 - two-way relationship.

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